

WHAT IS CLAIMED IS:

1. A tube guide for a ball screw comprising a screw shaft including a spiral-shaped ball rolling groove formed in an outer peripheral surface thereof; a nut including a spiral-shaped ball rolling groove formed in an inner peripheral surface thereof; a plurality of balls disposed in a ball rolling passage formed by the two ball rolling grooves; and, a ball circulation tube forming a ball circulation passage and including a ball scooping portion in an end portion thereof, the balls being scooped up at the ball scooping portion so as to circulate along the outer surface of the nut,

wherein the tube guide is used for mounting the ball circulation tube onto the nut, has an outer shape matched to the inner shape of a tube guide insertion hole formed in the nut so as to correspond to the insertion position of the ball scooping portion, and includes a scooping portion insertion hole consisting of a penetration hole formed so as to have an inner shape matched to the outer shape of the ball scooping portion, and

wherein the tube guide is interposed between the ball scooping portion and the tube guide insertion hole.

2. A tube guide for a ball screw as set forth in claim 1, wherein the inner shape of the tube guide insertion hole

is formed a cylindrical shape.

3. A tube guide for a ball screw as set forth in claim  
2, wherein the axial line of the cylindrical shape is set  
5 perpendicular to the axial line of the nut.

4. A tube guide for a ball screw as set forth in Claim  
1, wherein the scooping portion insertion hole has a ball  
circulation passage scooping angle set so as to correspond to  
10 the lead angle of the ball screw.

5. A tube guide for a ball screw as set forth in Claim  
2, wherein the scooping portion insertion hole has a ball  
circulation passage scooping angle set so as to correspond to  
15 the lead angle of the ball screw.

6. A tube guide for a ball screw as set forth in Claim  
3, wherein the scooping portion insertion hole has a ball  
circulation passage scooping angle set so as to correspond to  
20 the lead angle of the ball screw.

7. A tube guide for a ball screw as set forth in Claim  
1, wherein the tube guide is made of elastic material.

25 8. A tube guide for a ball screw as set forth in Claim

2, wherein the tube guide is made of elastic material.

9. A tube guide for a ball screw as set forth in Claim 3, wherein the tube guide is made of elastic material.

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10. A tube guide for a ball screw as set forth in Claim 6, wherein the tube guide is made of elastic material.

11. A ball screw comprising:

10 a screw shaft including a spiral-shaped ball rolling groove formed in an outer peripheral surface thereof;

a nut including a spiral-shaped ball rolling groove formed in an inner peripheral surface thereof;

a plurality of balls disposed in a ball rolling passage  
15 formed by the two ball rolling grooves; and,

a ball circulation tube forming a ball circulation passage and including a ball scooping portion in an end portion thereof, the balls being scooped up at the ball scooping portion so as to circulate along the outer surface of the nut,

20 wherein the nut includes a tube guide insertion hole corresponded to the insertion position of the ball scooping portion, and the ball circulation tube is mounted on the nut through a tube guide as set forth in Claim 1 between the ball scooping portion and the tube guide insertion hole.

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12. A ball screw comprising:

a screw shaft including a spiral-shaped ball rolling groove formed in an outer peripheral surface thereof;

5 a nut including a spiral-shaped ball rolling groove formed in an inner peripheral surface thereof;

a plurality of balls disposed in a ball rolling passage formed by the two ball rolling grooves; and,

a ball circulation tube forming a ball circulation passage and including a ball scooping portion in an end portion thereof,  
10 the balls being scooped up at the ball scooping portion so as to circulate along the outer surface of the nut,

wherein the nut includes a tube guide insertion hole corresponded to the insertion position of the ball scooping portion, and the ball circulation tube is mounted on the nut  
15 through a tube guide as set forth in Claim 2 between the ball scooping portion and the tube guide insertion hole.

13. A ball screw comprising:

a screw shaft including a spiral-shaped ball rolling  
20 groove formed in an outer peripheral surface thereof;

a nut including a spiral-shaped ball rolling groove formed in an inner peripheral surface thereof;

a plurality of balls disposed in a ball rolling passage formed by the two ball rolling grooves; and,

25 a ball circulation tube forming a ball circulation passage

and including a ball scooping portion in an end portion thereof,  
the balls being scooped up at the ball scooping portion so as  
to circulate along the outer surface of the nut,

wherein the nut includes a tube guide insertion hole  
5 corresponded to the insertion position of the ball scooping  
portion, and the ball circulation tube is mounted on the nut  
through a tube guide as set forth in Claim 3 between the ball  
scooping portion and the tube guide insertion hole.

10 14. A ball screw comprising:

a screw shaft including a spiral-shaped ball rolling  
groove formed in an outer peripheral surface thereof;

a nut including a spiral-shaped ball rolling groove formed  
in an inner peripheral surface thereof;

15 a plurality of balls disposed in a ball rolling passage  
formed by the two ball rolling grooves; and,

a ball circulation tube forming a ball circulation passage  
and including a ball scooping portion in an end portion thereof,  
the balls being scooped up at the ball scooping portion so as  
20 to circulate along the outer surface of the nut,

wherein the nut includes a tube guide insertion hole  
corresponded to the insertion position of the ball scooping  
portion, and the ball circulation tube is mounted on the nut  
through a tube guide as set forth in Claim 6 between the ball  
25 scooping portion and the tube guide insertion hole.

15. A ball screw comprising:

a screw shaft including a spiral-shaped ball rolling groove formed in an outer peripheral surface thereof;

5 a nut including a spiral-shaped ball rolling groove formed in an inner peripheral surface thereof;

a plurality of balls disposed in a ball rolling passage formed by the two ball rolling grooves; and,

a ball circulation tube forming a ball circulation passage  
10 and including a ball scooping portion in an end portion thereof, the balls being scooped up at the ball scooping portion so as to circulate along the outer surface of the nut,

wherein the nut includes a tube guide insertion hole corresponded to the insertion position of the ball scooping  
15 portion, and the ball circulation tube is mounted on the nut through a tube guide as set forth in Claim 10 between the ball scooping portion and the tube guide insertion hole.

16. A method for manufacturing a ball screw comprising:

20 a screw shaft including a spiral-shaped ball rolling groove formed in an outer peripheral surface thereof; a nut including a spiral-shaped ball rolling groove formed in an inner peripheral surface thereof; a plurality of balls disposed in a ball rolling passage formed by the two ball rolling grooves; and, a ball  
25 circulation tube forming a ball circulation passage and

including a ball scooping portion in an end portion thereof,  
the balls being scooped up at the ball scooping portion so as  
to circulate along the outer surface of the nut, comprising  
steps of:

- 5           forming a tube guide insertion hole on the nut at a position  
corresponding to the insertion position of the ball scooping  
portion;

          mounting the tube guide as set forth in Claim 1 on the  
two end portions of the ball circulation tube;

- 10           inserting the two end portions of the ball circulation  
tube with the tube guide into the tube guide insertion holes;  
and,

          fixing the ball circulation tube to the nut.

- 15           17. A method for manufacturing a ball screw comprising:  
a screw shaft including a spiral-shaped ball rolling groove  
formed in an outer peripheral surface thereof; a nut including  
a spiral-shaped ball rolling groove formed in an inner peripheral  
surface thereof; a plurality of balls disposed in a ball rolling  
20    passage formed by the two ball rolling grooves; and, a ball  
circulation tube forming a ball circulation passage and  
including a ball scooping portion in an end portion thereof,  
the balls being scooped up at the ball scooping portion so as  
to circulate along the outer surface of the nut, comprising  
25    steps of:

forming a tube guide insertion hole on the nut at a position corresponding to the insertion position of the ball scooping portion;

mounting the tube guide as set forth in Claim 2 on the  
5 two end portions of the ball circulation tube;

inserting the two end portions of the ball circulation tube with the tube guide into the tube guide insertion holes;  
and,

fixing the ball circulation tube to the nut.

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18. A method for manufacturing a ball screw comprising:  
a screw shaft including a spiral-shaped ball rolling groove  
formed in an outer peripheral surface thereof; a nut including  
a spiral-shaped ball rolling groove formed in an inner peripheral  
15 surface thereof; a plurality of balls disposed in a ball rolling  
passage formed by the two ball rolling grooves; and, a ball  
circulation tube forming a ball circulation passage and  
including a ball scooping portion in an end portion thereof,  
the balls being scooped up at the ball scooping portion so as  
20 to circulate along the outer surface of the nut, comprising  
steps of:

forming a tube guide insertion hole on the nut at a position corresponding to the insertion position of the ball scooping portion;

25 mounting the tube guide as set forth in Claim 3 on the



two end portions of the ball circulation tube;

inserting the two end portions of the ball circulation tube with the tube guide into the tube guide insertion holes; and,

5 fixing the ball circulation tube to the nut.

19. A method for manufacturing a ball screw comprising: a screw shaft including a spiral-shaped ball rolling groove formed in an outer peripheral surface thereof; a nut including  
10 a spiral-shaped ball rolling groove formed in an inner peripheral surface thereof; a plurality of balls disposed in a ball rolling passage formed by the two ball rolling grooves; and, a ball circulation tube forming a ball circulation passage and including a ball scooping portion in an end portion thereof,  
15 the balls being scooped up at the ball scooping portion so as to circulate along the outer surface of the nut, comprising steps of:

forming a tube guide insertion hole on the nut at a position corresponding to the insertion position of the ball scooping  
20 portion;

mounting the tube guide as set forth in Claim 6 on the two end portions of the ball circulation tube;

inserting the two end portions of the ball circulation tube with the tube guide into the tube guide insertion holes;  
25 and,

fixing the ball circulation tube to the nut.

20. A method for manufacturing a ball screw comprising:  
a screw shaft including a spiral-shaped ball rolling groove  
5 formed in an outer peripheral surface thereof; a nut including  
a spiral-shaped ball rolling groove formed in an inner peripheral  
surface thereof; a plurality of balls disposed in a ball rolling  
passage formed by the two ball rolling grooves; and, a ball  
circulation tube forming a ball circulation passage and  
10 including a ball scooping portion in an end portion thereof,  
the balls being scooped up at the ball scooping portion so as  
to circulate along the outer surface of the nut, comprising  
steps of:

forming a tube guide insertion hole on the nut at a position  
15 corresponding to the insertion position of the ball scooping  
portion;

mounting the tube guide as set forth in Claim 10 on the  
two end portions of the ball circulation tube;

inserting the two end portions of the ball circulation  
20 tube with the tube guide into the tube guide insertion holes;  
and,

fixing the ball circulation tube to the nut.

21. A method for manufacturing a ball screw comprising:  
25 a screw shaft including a spiral-shaped ball rolling groove

formed in an outer peripheral surface thereof; a nut including  
a spiral-shaped ball rolling groove formed in an inner peripheral  
surface thereof; a plurality of balls disposed in a ball rolling  
passage formed by the two ball rolling grooves; and, a ball  
5 circulation tube forming a ball circulation passage and  
including a ball scooping portion in an end portion thereof,  
the balls being scooped up at the ball scooping portion so as  
to circulate along the outer surface of the nut, comprising  
steps of:

10 forming a tube guide insertion hole on the nut at a position  
corresponding to the insertion position of the ball scooping  
portion;

mounting the tube guide as set forth in Claim 15 on the  
two end portions of the ball circulation tube;

15 inserting the two end portions of the ball circulation  
tube with the tube guide into the tube guide insertion holes;  
and,

fixing the ball circulation tube to the nut.

20 22. A method for manufacturing a ball screw as set forth  
in Claim 16, wherein, in a state where the two end portions  
of the ball circulation tube are inserted into a mold for molding  
a tube guide, material for the tube guide is poured into the  
tube guide molding mold and is hardened therein, whereby the  
25 step of manufacturing the tube guide and the step of mounting

the tube guide onto the two end portions of the ball circulation tube is executed at the same time.

23. A method for manufacturing a ball screw as set forth  
5 in Claim 17, wherein, in a state where the two end portions of the ball circulation tube are inserted into a mold for molding a tube guide, material for the tube guide is poured into the tube guide molding mold and is hardened therein, whereby the step of manufacturing the tube guide and the step of mounting  
10 the tube guide onto the two end portions of the ball circulation tube is executed at the same time.

24. A method for manufacturing a ball screw as set forth  
in Claim 18, wherein, in a state where the two end portions  
15 of the ball circulation tube are inserted into a mold for molding a tube guide, material for the tube guide is poured into the tube guide molding mold and is hardened therein, whereby the step of manufacturing the tube guide and the step of mounting the tube guide onto the two end portions of the ball circulation  
20 tube is executed at the same time.

25. A method for manufacturing a ball screw as set forth  
in Claim 19 wherein, in a state where the two end portions of the ball circulation tube are inserted into a mold for molding  
25 a tube guide, material for the tube guide is poured into the

tube guide molding mold and is hardened therein, whereby the step of manufacturing the tube guide and the step of mounting the tube guide onto the two end portions of the ball circulation tube is executed at the same time.

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26. A method for manufacturing a ball screw as set forth in Claim 20, wherein, in a state where the two end portions of the ball circulation tube are inserted into a mold for molding a tube guide, material for the tube guide is poured into the tube guide molding mold and is hardened therein, whereby the  
10 tube guide molding mold and is hardened therein, whereby the step of manufacturing the tube guide and the step of mounting the tube guide onto the two end portions of the ball circulation tube is executed at the same time.

15            27. A method for manufacturing a ball screw as set forth  
in Claim 21, wherein, in a state where the two end portions  
of the ball circulation tube are inserted into a mold for molding  
a tube guide, material for the tube guide is poured into the  
tube guide molding mold and is hardened therein, whereby the  
20 step of manufacturing the tube guide and the step of mounting  
the tube guide onto the two end portions of the ball circulation  
tube is executed at the same time.